

NEW DATA IN THE USE OF THERAPEUTIC EXERCISE IN DISEASES OF THE
PERIPHERAL VESSELS

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16. Abstract The paper summarizes experience gathered from the practice of exercise therapy in patients presenting diverse forms of occlusive lesions of arteries and veins and functional vascular disorders. Emphasis is laid on the fact that the study of the therapeutic exercise method reposes on the knowledge of clinical angiology. Observations showed an improvement in the cardiac function, peripheral circulation, along with an increased physical work capacity of the patients, which became evident in the course of graded physical training. All this suggests recommending exercise therapy as a means of rehabilitation early after operations on peripheral vessels. Differential procedures of therapeutic exercise with due consideration of the form and stage of the affection have been elaborated.			
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NEW DATA IN THE USE OF THERAPEUTIC EXERCISE IN DISEASES OF THE
PERIPHERAL VESSELSProfessor V. N. Moshkov and A. I.
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A study of therapeutic exercise in the treatment of diseases of the peripheral vessels develops in accordance with the achievements of clinical medicine and physiology. Thus, hypotheses of the neurogenic theory of the development of diseases have made it possible, for the first time, to base one's self on the position of the functional therapy and to summarize practical experience in using therapeutic exercise in the obliterative experiment (V. N. Moshkov). More exact definition of the characteristics of the pathogenesis and clinical course of occlusive diseases of the arteries and veins has led to the development of differentiated method of therapeutic gymnastics during these diseases (A. I. Zhuravleva, 1962, 1968, 1970). An improvement in vascular surgery has set before specialists of therapeutic exercise the task of studying the effect of physical exercises on surgical patients with chronic arterial and venous deficiency of the lower extremities (A. I. Zhuravleva, 1962; Ye. I. Yankelevich; I. S. Damsker; S. M. Kurbangaleyev et al., and others). In the foreign literature, special questions of therapeutic exercise are best expounded on in the studies of Buerger, Ratschow, and Ebel. The modern nature of this question in Soviet medicine is characterized by a striving to create optimal methods of physical exercises in the period of conservative and surgical treatment of patients with diseases of the peripheral vessels.

Our experience is based upon a study of the effect of therapeutic exercise in more than 600 patients with diseases of the peripheral vessels; with functional disorders (angiospasm), obliterative atherosclerosis, endarteritis

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*Numbers in the margin indicate pagination in the foreign text.

obliterans, chronic venous deficiency of the lower extremities (predominantly, postthrombophlebitic syndrome). The predominating number of patients were in the chronic phase of the disease, in the stage of compensation, and subcompensation of circulation, while part of the patients were in the stage of decompensation of circulation in the damaged extremities.

1 *Of the total number of patients, 122 in anamnesis were operations for occlusions of the arteries and veins (reconstructive operations on blood vessels, sympathectomy, etc.) in the period ranging from 2 to 3 weeks to several years following surgery.*

The expediency of measured amounts of physical conditioning is confirmed by experimental physiological and clinical data which indicate the capacity of physical exercises to improve the activity of the nervous, cardiovascular, respiratory and muscular systems of the organism and the metabolism. The neuro-humoral mechanism of action of physical exercises ensures regulation of processes at various levels of the central and peripheral nervous system.

An improvement in nervous trophic, the oxidation-reducing processes and tissue metabolism, as well as an increase in the functional capacity of the skeletal muscles creates capacities for the therapeutic effect of physical exercises in the case of illnesses of the peripheral vessels. It should be taken into account that physical exercises are among the therapeutic methods which develop compensator-adaptive reactions in the organism of the patient and are a means of decreasing physiological deficiency of collaterals.

It is known that compensator-adaptive changes in the trophic functions of tissues and circulation in the extremities can, in a number of patients, and over the course of a long period of time make possible good functioning of the extremity, notwithstanding widespread obturation of the main arteries (A. A. Vishnivskiy et al.).

The investigations which we conducted on 260 patients (rheovasography, arterial oscillography, skin electrothermometry, and capillaroscopy), showed that physical exercises improved the flow of arterial blood in damaged and healthy extremities of patients with obliterative atherosclerosis and endarteritis, and also decrease angiospastic reactions during functional

/19

disorders of the peripheral vessels and in postthrombophlebitic syndrome (Figure 1). However, the subject at hand is that of measured doses of physical exercises corresponding to the degree of vascular disorders and functional capacities of the neuro-muscular apparatus of the patient. Extreme physical exercises for a diseased extremity increase ischemia of the tissues.

Dosed physical exercises in therapeutic gymnastics, in addition to taking into account the basic pathological process in the peripheral vessels, are also based upon the condition of the overall hemodynamics. In connection with this, in patients with chronic arterial and venous deficiency of the lower extremities, teleelectrocardiographic investigations were carried out both during the therapeutic gymnastics and during the functional test with physical stress (the step-test).

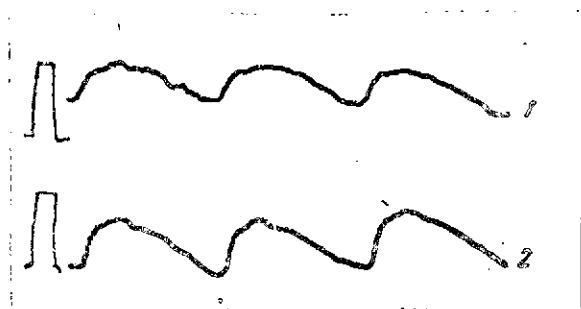


Figure 1. Rheovasogram of the Leg of a Patient with Atherosclerotic Stenosis of the Femoral Arteries Before (1) and After (2) Therapeutic Gymnastics.

During the examination of 120 patients (EKG was recorded according to the widely accepted method using 12 leads) it was found that 76% of the patients with chronic arterial deficiency (atherosclerosis, endarteritis, angiospasm) and in 50% of the patients with chronic venous deficiency of the lower extremities, there were various deviations of the EKG from the norm. In patients with peripheral atherosclerosis and cardiosclerosis,

there was a predominance of moderate and pronounced focal or diffuse changes of the myocardium, while in patients with angiospasm and chronic venous deficiency, disorders of the function of automatism, stimulation and conductance were primarily encountered; these were related to disorders of the neuro-vascular regulation.

Physical stress (the step-test) – walking up a two step ladder – caused pathological reactions of the cardiovascular system in two-thirds of the patients examined. During this process, an increase in the frequency of

cardiac contractions was noted in the restorative period, while in certain cases there were negative dynamics of the final part of the ventricular complex of the EKG.

The teleelectro- and ballistocardiographic investigations, compared with the subjective reactions to standard physical stress (the appearance of labored breathing, tachycardia, and overall fatigue in certain patients), indicated a significant decrease in the compensatory mechanisms of the cardiovascular system.

Changes in the EKG in the process of the exercises of therapeutic gymnastics consisted in a moderate increase in the frequency of cardiac contractions, an increase in the systolic index, an increase in the voltage of EKG spikes, and in some cases, in a decrease in the arterio-ventricular passage, with return of these indices to the norm in the restorative period following exercises. In patients who fulfilled the dosed physical exercises with a therapeutic goal, in the early periods following surgery on blood vessels (2-3 weeks), a larger increase was observed in the frequency of cardiac contractions: on the average 90.1, as opposed to 82 in those who did not undergo surgery (although therapeutic gymnastics in the postsurgical period were conducted with a lesser degree of stress). This can be explained by suppression of the compensatory reactions of the cardiovascular system caused primarily by surgery and the bedrest regime. /20

Observations show that early activation of patients with vascular diseases in the postoperative period is necessary for prophylaxis of thromboembolic complications (in complex with anticlotting therapy; V. S. Savel'yev), as well as with the goal of maintaining the functional condition of the cardiovascular system and the other systems of the patient's organism. |

The use of systematically adequate, dosed physical stress, in keeping with the condition of the patients in the pre and postoperative periods, in the form of therapeutic gymnastics and a regime of movement, leads to improvement of the functional condition of the cardiovascular system during chronic arterial and venous deficiency of the extremities. Thus, according to the EKG data, in 56% of such patients, following treatment, an improvement in the contractive function of the myocardium was observed.

Diseases of the peripheral blood vessels lead to a decrease in motor activity of the patient as the result of intermittent limping with occlusions of the arteries, and is the result of an increase in edema and pain in the legs in the case of chronic venous deficiency.

During investigations of the physical work capacity of 140 patients, significant individual variations were found. Thus, in the case of a necessary work power ranging from 200 to 800 kGm/min, its duration varied from 30 seconds to 5 minutes with the volume of work accomplished, on the average, being 1300 ± 80 kGm.

The pronounced decrease in work capacity of the muscles of the lower extremities was observed in patients with arterial deficiency of the lower extremities. In patients with chronic venous deficiency of the lower extremities, the work capacity of these muscles decreased to a lesser degree. With pronounced angiospastic reactions prior to therapy, pain appeared frequently in the first 30 to 40 seconds of carrying out the step-test. Dynamic observations established that the capacity for fulfilling muscular work in the lower extremities is determined by at least two factors: 1) the condition of metabolic processes in the muscles of the extremities, caused by the degree of obliteration of the main arteries and functioning collaterals; and 2) the condition of the vasomotor reflexes. The latter situation is attested to by the fact that following treatment with the application of therapeutic exercise, when there is an improvement in reflex links of the vascular and muscular systems, physical work capacity of patients suffering from obliterative diseases of the arteries of the extremities and angiospasm significantly increases.

We shall also note that there was an increase in work capacity of muscles following complex treatment of patients presented in the early period following surgery. The restoration of blood flow as the result of successful reconstructive operations on the arteries and veins makes it possible, in fact, in the early postoperative period most effectively to carry out rehabilitative measures. In patients of this group, following treatment by the aid of therapeutic exercise and balneo-physical therapy (R. F. Akulova), we noted a statistically reliable increase in physical work capacity — from 1300 ± 80 to 1800 ± 105 kGm ($P < 0.01$).

In patients with progressive systemic damage of the blood vessels, during decompensation of circulation in the injured extremities, therapeutic gymnastics makes possible maintenance of the functional condition of the neuro-muscular apparatus, although it does not cause a reliable increase in physical work capacity (Figure 2).

Dynamic phlebomanometric and phlebographic investigations in the norm and in pathology of veins (V. A. Val'dman; R. P. Zelenin; N. I. Krakovskiy R. M. Grigoryan; I. P. Dauderis; May; Pelug; Nachbur, etc.) revealed the great role of contractions of the skeletal muscles in the venous circulation, which provides a basis to call the work of the muscles the basis of the moving force of the venous blood flow (I. M. Tal'man; Kappert).

It has been established that contraction of the muscles of the extremities in walking, under physiological conditions, causes an acceleration in the outflow of blood along the veins in the direction of the heart. Venous hemodynamics is also actively influenced by respiratory and active respiratory exercises. The phases of breathing in their correct combination with movements of the muscles make possible successive movement of blood from the lower extremities to the thoracic cavity (at exhalation) and to the right auricle (at inhalation).

Hence, contraction of the muscles of the extremities and respiratory exercises make possible normalization of the venous outflux of blood. At the same time, a man's prolonged stay in a standing position causes stenosis of blood in the veins of the legs as the result of static muscle stress.

We have established that for patients with valvular deficiency of the main and communicating veins of the lower extremities, during their varicose dilation and postthrombophlebitic syndrome it is expedient to have therapeutic gymnastics in the prone position with a raised support and an elastic band (a stocking) on the injured extremity and the therapeutic gymnastics should be carried out against the background of a regime of motions, prescribed periods of walking and physical exercises combined with rest in the prone position. Accumulated experience enables one to affirm that therapeutic gymnastics are widely indicated during treatment of illnesses of the peripheral vessels. Counterindications for prescribing therapeutic gymnastics can be: 1) acute

thromboses of the arteries and veins of the extremities accompanied by the patients being in a severe condition with both systemic and localized inflammatory reactions; 2) progressive necrosis of tissues of the extremities with sharply pronounced pains at rest.

Dosed physical exercises are determined by the condition of the local and systemic circulation and by the periods which have passed following surgery or the aggravation of the vascular illness. For patients with decompensation of circulation in the extremities, as well as in the first days following surgery on blood vessels or following acute thrombophlebitis, therapeutic gymnastics are conducted according to an individually selected method. The principal of an individual approach is particularly important for patients with pronounced systemic atherosclerosis.

In ordinary cases one begins with exercises for healthy extremities and respiratory exercises in the prone and sitting positions (with venous deficiency of the legs — lying in bed with a support). Exercises for the diseased (post-surgical) extremity are at first carried out passively, with a gradually increasing amplitude, and then transition is made to active exercises and exercises with strengthening of the muscles of the damaged extremity. For patients with chronic arterial and venous deficiency of the lower extremities, therapeutic gymnastics are conducted by the group method. Physical exercises of a dynamic character are employed with an element of strength tension on the leg muscles, and on weakened muscles, and exercises on gymnastic equipment and with weights are carried out. The procedure of therapeutic gymnastics provides for a routine of starting postures: lying, sitting, standing, and walking for carrying out the special and overall strengthening exercises.

Significant activation of the peripheral circulation is achieved with accomplishment by the patient of exercises involving active stress on the muscles of the foot, leg, and thigh of the "pedal pressing", "bicycle" type, with exercises for the legs using rubber straps, etc. In the case of arterial deficiency of the lower extremities these exercises are begun in the seated and lying positions, while with venous deficiencies they are begun with lying on a couch raising the legs, feet foremost, at an angle of 15-45°.

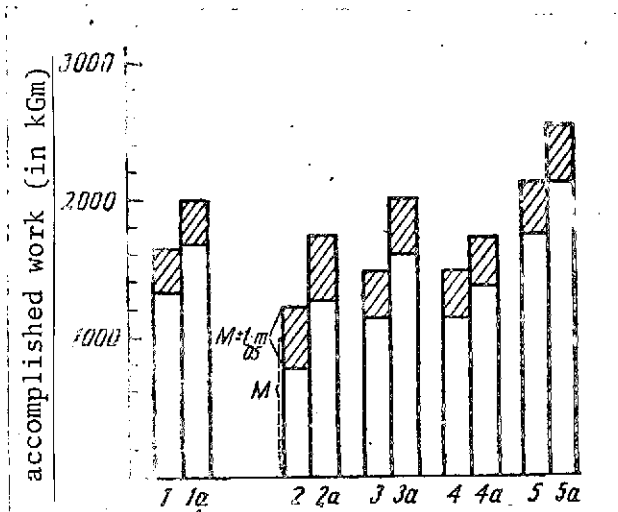


Figure 2. Physical Work Capacity of Patients Before (1-5) and After (1a-5a) Treatment. 1, 1a, All examined patients; 2, 2a, following operations on arteries; 3, 3a, following operations on arteries and veins; 4, 4a, chronic arterial deficiency; 5, 5a, chronic venous deficiency. Coverage of mean errors (striped regions) of the two adjacently located columns signifies statistically unreliable changes in the physical work capacity following treatment (4, 4a).

Besides therapeutic gymnastics, in the course of the day it is expedient to conduct repeated but short term isometric exercises of the muscles of the leg and prescribe periods of walking up to a point of appearance of fatigue in the leg muscles.

Observations have shown that physical exercises during chronic diseases of the peripheral vessels should be carried out systematically and over a long period of time, with the addition of other methods of treatment.

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